Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

ANSWER TO QUERY 1, PAGE 64.

BY PROF. D. J. MC ADAM, WASHINGTON, PENNSYLVANIA.

"When we descend below the surface of the Earth, does the Earth's attractive force increase or diminish?"

If the Earth were homogeneous, attraction for all points beneath the surface would vary directly as the distance from the center, hence would be a maximum at the surface.

The results of all the pendulum experiments made at the top and bottom of mines prove that the force of attraction is greater at the bottom of the mine than at the top. For instance, it was found in the experiment made in a mine near New Castle, England, that a pendulum which vibrated seconds at the top of the mine, gained 2¼ seconds per day when carried down 1256 ft. That is, the force of attraction at the bottom of the mine is about 0.00005 greater than at the surface. Concerning the force of attraction at other less distances from the center, we can only conjecture with more or less probability of being right.

We know from these and other experiments, that the mean density of the portion left after a shell about ¼ mile thick is taken off, is about 2 or 2½ as great as the density of that shell.

Whether the remaining nucleus is homogeneous and the attractive force continually decreases as we approach its center, or whether the density varies according to any assumed law we cannot certainly say. We would be slow to accept the hypothesis that the bottom of the deepest mine happens to be in the dividing surface between the less dense shell and the homogeneous more dense nucleus. Indeed, that there is such dividing surface anywhere clearly marked is contradictory of all that we know of increase of density under increase of pressure.

It has been proved that if the Earth is homogeneous and its shape the same as if it were entirely fluid, the ellipticity must be $\frac{1}{230}$. Clairaut proved that Newton was in error when he supposed that if instead of being of uniform density the Earth were denser toward the center, the ellipticity ought to be greater, but, contrarywise, the ellipticity ought to be less than for a homogeneous Earth.

Measurements of arcs of meridians demonstrate that the ellipticity is less than $\frac{1}{230}$. So far there is agreement between the theory of heterogeniety and observation.

The hypothesis concerning the density of the interior strata which seems as probable as any that has been made is that assumed by Laplace. It had been given before by Legendre as an Exam. to which to apply his formula.

Laplace assumed such law of increase of density from surface to center as would make the differential equation for the ellipticities of the strata

$$\frac{d^2}{da^2}\left[\varphi(a)e\right] = \frac{6}{a^2}\,\varphi(a)e+3a^2e\frac{d\rho}{da} \tag{1}$$

integrable.

By assuming that the last term of the second member of equation (1) is a function of a, Pratt, in his "Figure of the Earth," deduced the result

$$\rho = Q\frac{\sin qa}{a},$$

in which $\rho =$ the density, Q and q are constants, and $a =$ radius of shell considered as spherical.

The constants q and Q are found from the conditions that the density at the surface is 2.75, and the mean density of the Earth is twice that of the surface.

By means of the densities thus found, Pratt deduces the masses of the nucleus, and four concentric shells, the radius of the nucleus and the thickness of each shell being equal to one fifth of the Earth's radius.

The masses in order from the surface are, 0.3372, 0.3257, 0.2237, 0.0981, 0.0153, the mass of the Earth being unity.

From these values the masses of the parts whose radii are R, $\frac{4}{5}R$, $\frac{3}{5}R$, $\frac{2}{5}R$ and $\frac{1}{5}R$ are found to be 1.0000, 0.6628, 0.3371, 0.1134, 0.0153.

Taking the formula for attraction at the surface, each mass considered a sphere, $A=m\div R^2$, we get in order from the surface, $\frac{1}{25}(1.0000)$, $\frac{1}{16}(0.6628)$, $\frac{1}{9}(0.3371)$, $\frac{1}{4}(0.1134)$, 0.0153, or, 0.0400, 0.0414, 0.03746, 0.0284, 0.0153.

If this is the true law, the force of attraction increases from the surface till we reach a point perhaps one-third distant from surface to center, from that point the force diminishes and becomes zero at the center.

SOLUTION OF THE PROBLEM PROPOSED BY MR. HARVILL AT THE CLOSE OF HIS SOLUTION ON PAGE 56.

BY THE EDITOR.

Let A represent the center of the sphere, radius r, BCD a tri-rectangular spherical triangle, and $AEFGHPCI$, the solid removed from this portion of the sphere in making the first hole.

Draw BPh, DPi and CP, arcs of great circles respectively through BP, DP and CP, and draw HPj, IPk, small circles thro' P with poles at B, D.